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Original Article

Development of a self-management behaviour scale for liver cirrhosis

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ABSTRACT

Objective: To develop a self-management behaviour tool for liver cirrhosis patients in China.

Methods: A provisional scale comprising 30 items was developed based on the results of literature review, semi-structured interviews, expert consultation and pilot study. Patients with hepatic cirrhosis ($n = 180$) from four grade A tertiary hospitals in Tianjin and Handan Infectious Disease Hospital were assessed using the provisional self-management scale comprising 30 items in four dimensions. The reliability and validity of the scale were tested and a final version of the self-management scale for liver cirrhosis comprising 24 items was concluded.

Results: The overall Cronbach's α for the scale was 0.80, ranging from 0.60 to 0.69 in each dimension. The test–retest correlation was 0.84, ranging from 0.54 to 0.72 in each dimension. Content validity for the scale was 0.93. Nine factors were extracted by a factor analysis method, which were limited to four factors according to a scree test. The cumulative variance contribution rate was 56.98%.

Conclusion: This scale has good reliability and validity and can be used to evaluate self-management behaviour of hepatic cirrhosis patients and provides a reference for behaviour intervention.

1. Introduction

Liver cirrhosis patients endure an irreversible and progressive illness of prolonged duration that is accompanied by many complications. Liver cirrhosis thus becomes both a physical and mental condition without a reliable treatment that substantially affects the patient's quality of life [1]. In many European countries, evaluation of chronic disease self-management projects indicate that they not only

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Table 1 – The provisional self-management behaviour scale for liver cirrhosis.

Dimension	Items
Dietary	1. You keep a high protein diet every day (1.0–1.5 g/kg body weight), such as lean meat, fish, chicken, soy and milk, but when you have hepatic encephalopathy signs, you will limit the intake of protein
	2. You avoid overeating every day, such as eating a lot of animal protein or drinking a lot of soybean milk in a short time
	3. You can control high-fat food intake, such as fat, animal brain, butter, ice cream, tried food, etc.
	4. You eat fresh fruit and vegetables every day to supplement calcium, zinc, selenium and vitamins
	5. You eat slowly, and do not eat coarse food such as chip husks, hard bones, shells, hard rice, fried celery, bamboo shoots, etc.
	6. You can control the intake of strong stimulant foods, beverages and condiments, such as coffee, strong tea, thick gravy, onions, leeks, garlic, chili, pepper, mustard, overheating and too cold food, etc.
	7. You can control the intake of sodium, <2 g/day, and do not eat pickles, preserved egg, ham, sausage, bacon, etc.
	8. When you fatigue, urinate more or experience abdominal distension, you will increase potassium intake under guidance of physician, or restrict potassium intake when you urinate less
	9. You eat smaller, more frequent meals, 4–6 times/day and diet regularly
	10. You do not drink alcohol
Daily life	11. You keep underwear and bedding clean and sanitized, changing them often
	12. You keep your skin clean and avoid scratches, and use warm water to scrub or pat, or besmear antipruritics such as itching tincture when your skin itches
	13. You keep your mouth clean and sanitized, rinse your mouth after meals, avoid puncture, use soft hair to brush your teeth, without a toothpick at the table, etc.
	14. You can increase or decrease clothes according to seasonal weather changes, making sure to keep warm during cold seasons and at night
	15. You put your feet in hot water 30 min before you go to sleep every day, and when necessary, you also utilize a foot massage and acupuncture points
	16. You fall asleep regularly every day, sleep eight hours and take a nap for one hour
	17. You combine work and play, do not overwork or stress, or perform entertainment activities (watch TV, play mahjong) for too long
	18. You keep a moderate aerobic activity for 30 min every day, such as indoor walking, setting-up exercise, jogging, etc.
	19. You try to change your impatient, out of temper and self-destructive personality
	20. You are able to actively communicate with family members, relatives and friends
	21. You have determination and confidence to fight chronic diseases and keep the spirit of optimism
Medication	22. You rarely use acetanilide, sleeping or sedative drugs
	23. You follow the doctor's advice to take medicine on time and the correct amount, according to the course of medication, and do not stop drug use without authorization, especially antiviral drugs
	24. You do not mess with drugs, do not listen to roving doctors, false advertising, superstition, religious offering of medicine or use drugs blindly
	25. You do not use medicines that easily cause liver damage
Illness monitoring	26. When you have symptoms such as upset stomach, haematemesis, black stool or skin, mucous membrane bleeding, ecchymosis, or lower limb oedema, you will ask for medical treatment in a timely manner
	27. You avoid elevating intra-abdominal pressure, such as by rough coughing, forcible defecation, vomiting, sneezing, hiccupping or lifting heavy objects
	28. When you experience abdominal tenderness, bounce painful or mild periumbilical ache, you will seek medical treatment in a timely manner
	29. You weigh yourself regularly (every day) and measure abdominal girth
	30. You go for regular evaluation of electrolyte, blood glucose, alanine aminotransferase and albumin levels, prothrombin time and B ultrasound

improve the participants' health, but also significantly reduce the number and duration of hospital stays, as well as medical costs [2]. However, chronic disease self-management scale research in China has been focused on diabetes, hypertension and coronary heart disease [3–5]. Therefore, the aim of this study was to develop a self-management behaviour assessment scale for patients with liver cirrhosis in order to effectively, scientifically and objectively evaluate their level of self management, and provide a basis for clinical nursing.

2. Subjects and methods

2.1. *Research subjects*

2.1.1. *Selection criteria*

Inclusion: i) patients admitted to hepatology units and in accordance with the Viral Hepatitis Prevention and Treatment plan in 2000 diagnosed with liver cirrhosis; ii) patients ≥18 years of age; iii) patient can express his/her wish accurately,

has the ability to communicate effectively; iv) achieved at least a primary school level of education; v) provided informed consent and willingness to participate in the study.

Exclusion criteria: i) patients with speech and hearing disorders, severe cognitive impairment or consciousness disorder; ii) patients with acute critical illness; iii) class C Child-Pugh classification; iv) patients who had previously received systematic normal self-management education.

2.1.2. *Interview subjects*

Nine patients admitted to the digestive system department in the Tianjin First Central Hospital between April and May 2013 were selected by sortation as interview subjects. The group was comprised of six men and three women 35–72 yr of age. The course of cirrhosis ranged from 2 to 24 yr, four had Child-Pugh class A disease, and five were class B. Two subjects had a primary education level, four had a middle education and three samples had senior or above level of education. Eight subjects were married and one was widowed.

2.1.3. *Pretest subjects*

Thirty liver cirrhosis patients from the Tianjin First Central Hospital were selected between May and June 2013 using a purpose sampling method in order to conduct a pretest trial.

2.1.4. *Formal test subjects*

A convenience sampling method was used to selecting 180 patients with liver cirrhosis from the Tianjin First Central Hospital, the Third Central Hospital, the Second People's Hospital, the First Affiliated Hospital of Tianjin Medical University and Handan Infectious Disease Hospital from June to September 2013. The group was comprised of 131 men and 49 women with a mean age of 54 ± 12 yr (range: 30–82 yr). Diagnoses included: viral hepatitis cirrhosis (n = 149), autoimmune liver cirrhosis (n = 16), alcoholic liver cirrhosis (n = 9), cholestasis liver cirrhosis (n = 3) and unknown cause (n = 3). Among the subjects, 113 had Child-Pugh class A liver cirrhosis and 67 had class B, with an average disease course of 6 yr (range: 1–45 yr) and an average of four hospitalizations (range: 1–28 stays). Forty-nine subjects had a primary education level, 55 had a middle education, 41 had senior or secondary technical education and 35 subjects had college or undergraduate education. Seven of the subjects were widowed, and 173 were married.

The study procedures were approved by the Tianjin University of Traditional Chinese Medicine. A written consent obtained from the patients after explaining the aim of the study, its benefits and risks, duration of the study and the data collection tools. Patients assured that they can withdraw at any time from research without any effect on the treatment. Patients assured about confidentiality of all data.

Table 2 – Item analysis of the provisional self-management behaviour scale for liver cirrhosis.

Item	Pearson's correlation[a]		Cronbach's α	High score (n = 49)	Low score (n = 49)	t	p
	r	p					
1	0.47	0.000	0.73	3.47 ± 0.68	2.67 ± 0.99	4.65	0.000
2	0.43	0.005	0.73	3.59 ± 0.61	3.08 ± 1.08	2.89	0.007
3	0.39	0.001	0.73	3.57 ± 0.58	2.92 ± 1.06	3.20	0.005
4	0.51	0.000	0.73	3.33 ± 0.66	2.53 ± 0.82	5.30	0.000
5	0.53	0.000	0.73	3.49 ± 0.89	2.43 ± 1.15	5.09	0.000
6	0.47	0.000	0.73	3.53 ± 0.68	2.80 ± 0.98	4.32	0.000
7	0.51	0.000	0.73	3.39 ± 0.70	2.51 ± 0.98	5.09	0.000
8	0.68	0.000	0.72	3.59 ± 0.67	2.04 ± 0.96	9.28	0.000
9	0.51	0.000	0.73	3.08 ± 1.02	2.02 ± 0.90	5.47	0.000
10	0.44	0.000	0.73	4.00 ± 0.00	3.27 ± 1.09	4.70	0.000
11	0.57	0.000	0.73	3.96 ± 0.20	3.37 ± 0.78	5.13	0.000
12	0.66	0.000	0.72	3.88 ± 0.33	2.69 ± 1.18	6.78	0.000
13	0.64	0.000	0.73	3.84 ± 0.37	2.65 ± 1.01	7.69	0.000
14	0.48	0.000	0.73	3.94 ± 0.32	3.39 ± 0.79	4.55	0.000
15	0.20	0.081	0.73	2.71 ± 1.24	2.37 ± 1.13	1.45	0.394
16	0.51	0.000	0.73	3.49 ± 0.74	2.53 ± 1.00	5.39	0.000
17	0.58	0.000	0.73	3.76 ± 0.56	2.51 ± 1.10	7.05	0.000
18	0.02	0.382	0.74	2.27 ± 1.32	2.43 ± 1.21	0.64	0.110
19	0.56	0.000	0.73	3.71 ± 0.68	2.39 ± 1.08	7.30	0.000
20	0.54	0.000	0.73	3.76 ± 0.69	2.55 ± 1.12	6.40	0.000
21	0.05	0.959	0.74	2.18 ± 1.22	2.35 ± 1.33	0.63	0.334
22	0.55	0.000	0.73	3.78 ± 0.51	2.94 ± 1.11	4.80	0.000
23	0.45	0.000	0.73	3.98 ± 0.14	3.37 ± 0.83	5.06	0.000
24	0.46	0.000	0.73	4.00 ± 0.00	3.16 ± 1.14	5.13	0.000
25	0.42	0.000	0.73	3.96 ± 0.20	3.24 ± 1.05	4.67	0.000
26	0.52	0.000	0.73	3.76 ± 0.69	2.88 ± 1.01	5.00	0.000
27	0.73	0.000	0.72	3.90 ± 0.31	2.55 ± 1.00	9.01	0.000
28	0.73	0.000	0.72	3.80 ± 0.64	2.39 ± 1.06	7.96	0.000
29	0.68	0.000	0.73	3.94 ± 0.24	3.10 ± 0.74	7.50	0.000
30	0.55	0.000	0.72	3.45 ± 0.77	2.16 ± 1.28	6.03	0.000

[a] Correlation with the total score; high score = top 27% of total points; low score = below 27% of total points; data are presented as Mean ± SD.

2.2. *Self-management behaviour scale*

2.2.1. *Pretest scale development*

The conception, development and application of self-management assessment was reviewed [6], and the scale was based on the self-management theory of Strauss and Corbin [7], which encompasses daily life management, disease medical management and emotional cognition management. A literature search was conducted for liver cirrhosis self-management, cirrhosis diagnosis and treatment guidelines and the clinical practice guidelines recommended by the European Association for the Study of the Liver (2010). Semi-structured interviews were conducted where the nine pretest subjects were asked what behaviours they thought were associated with their disease, and what changes they have made for the sake of their health.

The pretest interview entailed 36 items, for which a group of five experts was consulted to evaluate and amend in order to ensure the content validity of the project evaluation. The experts who were willing to participate were familiar with liver cirrhosis area and had a certain academic level in this area, who had at least a Bachelor's degree and had been working in this field for ten years: two nurses, one head nurse and two digestive internal medicine specialists. Two items that does not conform to or repeated content were subsequently removed ("follow the diet principle of high protein, low fat, appropriate sugar, high vitamin, soft, less slag and digestible", and "you would maintain emotional stability and avoid mood swings") and replaced with "you have a high-protein diet every day (1.0–1.5 g/kg body weight), such as lean meat, fish, chicken, soy and milk, but when you have a hepatic encephalopathy sign, you will restrict protein intake" and "you use diuretics in the daytime". Two additional items were rephrased: a question regarding intake of sodium was changed from "<3–5 g/day" to "<2 g/day", and a reference to "calamine lotion" was changed to "itching tincture" for a question inquiring about antipruritic treatment.

2.2.2. *Provisional scale formation*

The modified 36-item scale was then tested on 30 test subjects. The results were analysed using four statistical methods: i) discrete degree method: deletion standard is the standard deviation of items <0.75; ii) critical ratio method (extreme value method): the most commonly used method for discriminant index of project analysis [8], where an independent-sample *t* test shows no significant difference after the highest and lowest 27% are removed; iii) correlation coefficient method: deletion standard is the correlation coefficient of items < 0.75; iv) homogeneity test (homogeneity and load): determine product–moment correlation coefficient of the individual item and the total score [8], where the higher the individual item is associated with total score and the higher the homogeneity between the item and the overall scale, the closer the measured psychological traits and potential behaviours are; deletion standard is when the inter-community value is <0.20 (factor loading < 0.45). This analysis method identified 14 items for deletion; however, eight of these items were retained, resulting in a provisional scale of 30 items (Table 1). The results from the 30-item provisional scale were analysed using the correlation coefficient method, homogeneity test and the critical ratio method.

2.2.3. *Final scale formation*

The study population of 180 patients with liver cirrhosis were administered the scale questionnaire. The expert panel was once again consulted to evaluate the related degree and the importance of each item within each dimension of the

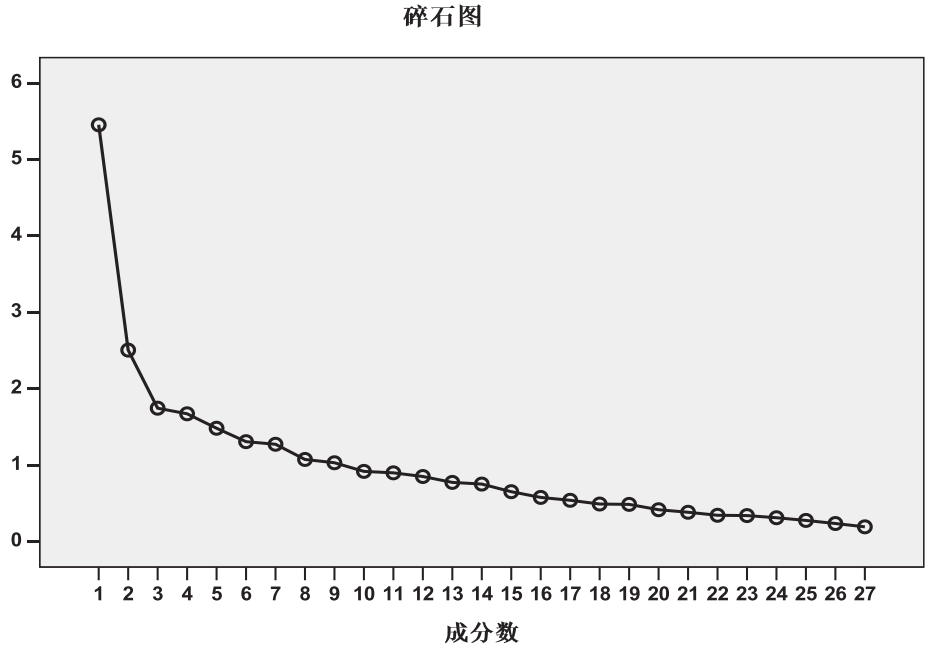

Fig. 1 – Scree test criterion factor analysis.

provisional scale using a three-level method: 1 point, "does not fit, you can delete"; 2 points, "will fit with modification"; three points, "fits, does not need to be modified". This evaluation ultimately led to the refinement of a final questionnaire of 24 items within four dimensions: daily-life management (seven items); dietary management (seven items); illness-monitoring management (five items); medication management (five items). A four-point Likert scale was used to evaluate answers: "all the time" (4 points); "most of the time" (3 points); "some of the time" (2 points); "rarely" (1 point); the possible range of scores was therefore 24–96 points, from worst to best self-management behaviour.

2.3. *Statistical analysis*

Epidata 3.1 software was used to input data to establish the database and filter items of the scale. Reliability and validity tests were performed using SPSS 17.0 software (SPSS Inc., Chicago, IL, USA). The validity of the scale was evaluated by the inherent correlation test using a Pearson's coefficient to test the correlation of the scale between various dimensions and between each dimension and population, opinions solicited from the experts to assess face validity, content validity index as a quantitative indicator of content validity, and the factor analysis method (orthogonal rotation) to test theory structure of the scale for structure validity. The reliability of the scale was evaluated using Cronbach's α to assess internal consistency reliability. To assess retest reliability, 30 of the subjects were selected by a random sampling method and retested after one week. The stability of the scale across time was assessed by calculating a Pearson's correlation coefficient between the two sets of results. Final results are described as percentage, or mean and standard deviation.

3. Results

3.1. *Item analysis*

The results from the 30-item provisional scale were analysed using the correlation coefficient method, homogeneity test and the critical ratio method. The critical ratios of three items (No. 15, 18 and 21; see Table 1) showed no statistical significance and the correlation coefficients between the items and the total score were <0.35 (Table 2). As a result, these items were deleted from the final scale.

3.2. *Validity test*

3.2.1. *Content validity test*

Content validity refers to whether all items of the scale measure the expected content, i.e. whether the subjects' understanding and responses are consistent with the intended measure. Based on the evaluation by the expert panel, the overall content validity index of the scale was 0.93, with each dimension ranging between 0.89 and 1.00.

3.2.2. *Exploratory factor analysis*

The Kaiser–Meyer–Olkin value of the scale was >0.5 (0.727), with a Bartlett's spherical test value of 1476.331 (df = 351;

Table 3 – Exploratory factor analysis (n = 180).

	Daily-life management			Dietary management			Illness-monitoring management			Medication management		
	Item	Loading	Communality	Item	Loading	Communality	Item	Loading	Communality	Item	Loading	Communality
	14	0.62	0.46	6	0.75	0.57	27	0.73	0.70	25	0.82	0.72
	20	0.56	0.37	3	0.67	0.51	30	0.70	0.57	24	0.75	0.60
	11	0.54	0.47	1	0.51	0.30	26	0.69	0.51	23	0.72	0.60
	13	0.52	0.52	7	0.50	0.28	28	0.52	0.51	8	0.62	0.47
	19	0.51	0.32	2	0.49	0.34	29	0.45	0.55	22	0.43	0.39
	16	0.50	0.27	5	0.41	0.37	–	–	–	–	–	–
	12	0.45	0.55	9	0.38	0.26	–	–	–	–	–	–
Eigen value	4.38			3.64			2.62			2.38		
Contribution rate (%)	21.01			15.93			10.23			9.81		
Accumulative contribution rate (%)	21.01			36.94			47.17			56.98		

$p = 0.00$), indicating that the data is suitable for exploratory factor analysis [9]. Therefore, a principal component analysis was used, and nine factors with a characteristic root >1 were extracted, the cumulative variance contribution rate was 65.00%. However, a scree test analysis showed that the slope levels off after four factors (Fig. 1). Next, we obtained an initial load matrix, and then performed maximum variance orthogonal rotation to obtain the final factor-loading matrix. To attribute four principal components (daily-life, dietary, illness-monitoring and medication management), the load values of items within factors were all above 0.40 (Table 3). Three items were removed (No. 4, 10 and 17; see Table 1) to form the final scale that is comprised of 24 items.

3.2.3. *Internal correlation test*

The four factors were significantly correlated, with Pearson correlation coefficients of 0.30–0.50 (Table 4). Moreover, each factor was significantly and positively correlated with the total scale score, with higher correlation coefficients of 0.67–0.83, indicating that individuals factors could be used as independent measures of the relevant variables. It also suggests that this scale has good structure validity (Table 4).

3.3. *Reliability test*

Assessment of the internal consistency showed an overall Cronbach's α coefficient of 0.80 for the scale, with a coefficient of 0.60–0.69 in each dimension. The scale also showed retest reliability with a correlation coefficient of 0.84 (0.54–0.72 for each dimension).

4. Discussion

4.1. *Analysis of validity and reliability*

Validity refers to the extent that a research tool reflects its expected concept; the greater the degree to which a tool reflects the expected research, the more valid it is. Commonly used validity indices include face validity, content validity, structure validity and criterion-related validity [10]. The scale in the present study demonstrated good content validity, as a result of incorporating a large body of relevant literature and interviews to formulate the item pool. Two rounds of discussions with an expert review the panel were then performed, and the original five-dimension, 36-item scale was modified and refined to 24 questions in four dimensions according to their evaluation opinions and preliminary experimental results.

Exploratory factor analysis and internal correlation tests were used to assess three aspects of structure validity: i) common factor conforms to the scale structure; ii) accumulated variance contribution ratio of each factor is ≥40%; iii) individual items show higher loading in one factor [10]. With this method, items with a factor loading value <0.40, common factors with loading values >0.40, and items with communalities <0.20 are excluded [4], which led to the deletion of three items.

This research adopted principal component analysis as a factor analysis method, and nine factors had characteristic roots >1. Four common factors were extracted by a scree test through maximum variance orthogonal rotation with a cumulative contribution rate of 56.98%. Each item within the corresponding factors had loading values above 0.40, representing the overall structure of the scale. These results are in line with a conceptual framework hypothesis, as the ownership of each of the items to the factors are the same. Factors were more strongly correlated to the scale than to each to other, indicating that the factors are related but different, which shows that the scale has good structure validity with high internal correlation.

Reliability refers to a degree of consistency of repeated measurements by a research tool; the higher the consistency of results, the higher the reliability of the tool [11]. The scale analysed in this study demonstrated a high degree of internal consistency as well as retest reliability.

Linlin and Chi [12] noted that the study of self-management abroad has been focused on how to evaluate the self-management effect, whereas domestic study has mainly been focused on the development of self-management scales and surveys of self-management levels. No literature concerning liver cirrhosis self-management scales in China are available, with a few reports regarding self-management education of liver cirrhosis patients, mainly concentrated improving their knowledge of liver cirrhosis, reducing the incidences of complications and improving their quality of life. In one such study, Han and Cai [13] conducted self-management education for 60 patients with liver cirrhosis using the disease knowledge questionnaire and a symptom self-assessment scale to test patients after one week and two days before leaving the hospital.

4.2. *Limitations and prospects*

The scale developed in this study demonstrated good reliability, validity and practicability. Therefore, this scale can serve as an effective tool for secondary prevention of liver cirrhosis and to improve patient quality of life. However, a

Table 4 – Reliability and validity ($n = 180$).

Management dimension	Reliability		Validity (r)			
	Homogeneity (α)	Retest (r)	Daily life	Dietary	Illness monitoring	Medication
Daily life	0.69	0.54	1	–	–	–
Dietary	0.60	0.61	0.43	1	–	–
Illness monitoring	0.61	0.72	0.32	0.30	1	–
Medication	0.65	0.62	0.50	0.31	0.41	1
Total	0.80	0.84	0.83	0.70	0.67	0.71

large majority of subjects included in this study had viral hepatitis cirrhosis and were selected from only four hospitals in Tianjin and one hospital in Handan, Hebei. Therefore, future research incorporating a larger region and patient population is needed to verify reliability and validity of the scale. Due to time constraints, we were unable to perform confirmatory factor analysis on this scale, which should be conducted in future research.

Self-management of liver cirrhosis is increasing, and training of patients on self-management techniques and providing health education can significantly improve their health-related quality of life. However, there is still a lack of research on development of liver cirrhosis self-management scales, although there have been studies involving nursing intervention in patients with cirrhosis. Although self-management of liver cirrhosis is challenging, it is also cost-effective, and should be discussed. This strategy also needs positive cooperation between primary care physicians, specialists, nurses and auxiliary medical personnel.

Conflicts of interest

The authors declare no potential conflicts of interest with respect to the research and/or publication of this article.

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